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# Description

# Teaching Sin and Cosine Instrument

## BACKGROUND OF INVENTION

[0001] 1) Field of the invention.

[0002] The invention relates to devices, which provides a teaching method for geometric concepts relating to a right triangle and the relationships that exist between its hypotenuse (R), the length of its two sides (X and Y) and the trigonometric functions.

[0003] Across the nation, schools are going through a major reform in their math and science curriculum to bring education standards up to par. The facts show that there is an achievement gap between blacks and whites in mathematics and science. In 1999, when the latest National Assessment of Education Progress (NAEP) test was administered, large differences remained between average scores for blacks and Hispanics on the one hand, versus whites and Asians on the other. Nationally, the achievement gap did not narrow at all during the 1990s. In reading and

math, gaps separating poor and minority students from others actually widened at most grade levels and remained the same or dropped only slightly at others (The Education Trust). By the end of grade 4, African American, Latino and poor students of all races are already about two years behind other students. By the time they reach grade 8, they are about three years behind. By the time they reach grade 12, if they do so at all, minority students are about four years behind other young people. The mathematics and science skills of 17-year-old African American and Latino students are similar to those of 13-year-old white students. African Americans and Latinos obtain college degrees at only half the rate of white students. The partnerships between government agency, industry, academia and private organizations are trying to address these issues along with many others. This invention provides a method for teaching the geometric concepts of a right triangle and trigonometric functions.

[0004] 2) Prior Art. The prior art consist of teaching the theory and equations for the geometry of a right triangle, its sides, angles and the relationship between the trigonometric functions. Lessons primarily consist of mathematical explanations and graphs of the trigonometric func-

tions. Equations such as Y = R sin θ or X = R cosine θ along with other trigonometric functions can be graphed and thus generate the resulting curves for each function.

[0005] The present invention, as distinguished from the prior art, provides a device that clearly demonstrates the relationship between a right triangle, its sides, angles, and trigonometric function. None of the prior art uses a device or tool that includes a horizontal and vertical ruler attached by a sliding attachment bracket along with a circular plate showing 360 degrees of the circle attached to the horizontal ruler along with a pivoting ruler that can rotate 360 degrees around the circular plate.

## Summary of Invention

[0006] The present invention is designed to teach the relationship between a right triangle, the length of its hypotenuse (R), the length of its two sides (X and Y) and the trigonometric functions.

[0007] One of the objectives of the present invention is to provide a device that will bring the level of learning and understanding of a right triangle and the trigonometric function to a conceptual level rather than just a fact remembering level as described in the Blooms Taxonomy.

[0008] Another objective is to clearly show how the cosine func-

tion is related to X/R, (the x axis/ the hypotenuse).

[0009] Another objective is to clearly show how the sine function is related to Y/R, (the y axis / the hypotenuse).

[0010] Another objective is to clearly show the remaining trigonometric functions (tangent, cotangent, secant, and cosecant) and their ratios to X, Y or R as defined for the sine and cosine functions above.

[0011] Another objective is to use the invention to generate graphs of the trigonometric function using data collected from measurements of the lengths of the rulers at their intersections and the angle.

## Brief Description of Drawings

[0012] Fig. 1 is an off angled view of the invention.

[0013] Fig. 2 is a front view of the invention.

## Detailed Description

[0014] The present invention is designed to teach the relationship between a right triangle, the length of its hypotenuse (R), the length of its two sides (X and Y) and the trigonometric functions.

[0015] Referring to Fig. 1, the device includes a horizontal ruler (X) and vertical ruler (Y) attached by a sliding attachment bracket. A circular plate showing 360 degrees of the circle

is attached to the horizontal ruler along with a pivoting ruler (R) that can rotate 360 degrees around the circular plate. By sliding the vertical ruler to different positions along the horizontal ruler and revolving the pivoting ruler to different angles (θ), the height of the vertical ruler where it intersects the pivoting ruler, the length of the of the horizontal ruler where it intersects the vertical ruler, and the length of the pivoting ruler where it intersects the vertical ruler can be measured. The trigonometric functions can then be calculated by their relationship with the measured values of X, Y, R and θ. For example, sin θ= Y / R and cosine θ= X / R. The sin and cosine functions and other trigonometric functions can be calculated and plotted (e.g. θ vs. Y/R) by varying the position of the rulers with respect to each other.

[0016] Classroom activities can be developed using the present invention that will increase the level of understanding of the trigonometric functions. One such activity involves leaving the pivoting ruler at a constant angle (e.g. 30 degrees). Slide the vertical ruler to different positions along the horizontal ruler. This allows the right triangle that is formed by the pivoting ruler, the vertical ruler and the horizontal ruler to change in size while keeping the length

of each ruler proportional to each other. Measure the length of the pivoting ruler (R), the horizontal ruler (X) and the vertical rulers (Y) for each position that the vertical ruler is moved to on the horizontal ruler. Calculate the ratio of X/R and Y/R for the different positions. Remember that the angle is kept constant. Students will find that the ratios X/R and Y/R will also remain constant even though the vertical ruler is moved to different positions on the horizontal ruler. The students learn that the cosine θ(X/R) and the sin θ(Y/R) will remain constant as long as the proportions of the right triangle are the same. The same method can be used for the other trigonometric functions. The present invention allows a more comprehensive understanding of the concepts of the trigonometric functions.

[0017] Another classroom activity involves moving the pivoting ruler to different angles. For example, starting at 0 degrees, move the pivoting ruler to different angles at increments of 15 degrees. The pivoting ruler can move all the way around the circle 360 degrees. Move the vertical ruler so that it is always intercepting the pivoting ruler. Measure the lengths of the rulers (X, Y, and R) for each angle θ. When the pivoting ruler is in the first quadrant, X and Y

will have positive values. When the pivoting ruler is in the second quadrant, X will have a negative value and Y will have a positive value. When the pivoting ruler is in the third quadrant, X and Y will have negative values. When the pivoting ruler is in the fourth quadrant, X will have a positive value and Y will have a negative value. R will always have a positive value no matter what quadrant the pivoting ruler is in. And it doesn't matter how big the triangle is as was learned in the previous activity because the ratio will stay constant for a given θ. Calculate the values for X/R and Y/R for each angle θ. Make a plot of θ vs. X/R and θ vs. Y/R. X/R and Y/R will be located on the y axis and θ will be on the x axis. The results of the plots will be the cosine curve and the sin curve. Participating in this activity with the present invention allows a more comprehensive understanding of the concepts of the trigonometric functions.